The future European CO_2 monitoring mission and the need for a multi-angle polarimeter to characterize the atmospheric light path

Jochen Landgraf[a,*], Otto Hasekamp[a], Stephanie Rusli[a], Trismono Krisna[a], Hein van Heck[a], Andre Butz[b], Bernd Sierk[c], and Yasjka Meijer[c]

[a]*SRON Netherlands Institute for Space Research, Utrecht, The Netherlands*
[b]*University of Heidelberg, Heidelberg, Germany*
[c]*ESA, Noordwijk, The Netherlands*

[*]*Presenting author (j.landgraf@sron.nl)*

The European Commission and the European Space Agency (ESA), together with European Centre for Medium-Range Weather Forecasts (ECMWF) and European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), plan to implement a future Copernicus mission for monitoring anthropogenic CO_2 emissions from space at country, regional and city scales (CO_2M mission). To this end, measurements of the CO_2 vertical column are required with high accuracy (<0.5 ppm) and precision (<0.7 ppm). The current mission design comprises a spectrometer covering the near and shortwave infrared spectral bands at 0.76, 1.6, and 2.0 μm with moderate spectral resolution. Although it is possible to infer aerosol information from these spectral bands simultaneously with the retrieval of atmospheric CO_2 abundance, the aerosol induced error represents a significant error source, which is mitigated in current missions by strict data screening and empirical bias corrections. This results in a poor data coverage in particular for areas with strong air pollution, like India and China, which are both areas of vital importance to be covered by the mission. Therefore, the future CO_2M mission will embark a multi-angle polarimeter as one payload component providing aerosol information for improved estimation of the atmospheric light path in different spectral bands and so to improve coverage and quality of the CO_2 data product. We demonstrate the mission performance including the gain in data quality and coverage by a synergistic use of both the CO_2 spectrometer and the multi-angle polarimeter. For this purpose, we analyze generic cases as well as ensembles of simulated measurements over central Europe and China. We conclude that the combination of the proposed state-of-the-art sensing concepts will be of great benefit to achieve the challenging mission objectives of the future European CO_2 monitoring mission.

Preferred mode of presentation: Oral